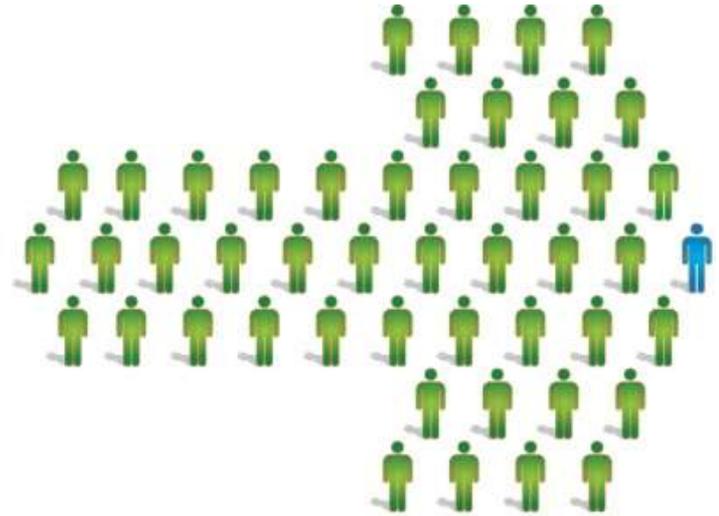


# TRENDS<sup>IN</sup> 21<sup>ST</sup> CENTURY



# EPIDEMIOLOGY

From Scientific Discoveries to Population Health Impact

DECEMBER 12-13, 2012- NIH CAMPUS, BETHESDA, MD

## Welcome and Charge

Muin J. Khoury, M.D., Ph.D.

EGRP, DCCPS, NCI

Commentary

## Frontiers in Cancer Epidemiology: A Challenge to the Research Community from the Epidemiology and Genomics Research Program at the National Cancer Institute

Muin J. Khoury, Andrew N. Freedman, Elizabeth M. Gillanders, Chinonye E. Harvey, Christie Kaefer, Britt C. Reid, Scott Rogers, Sheri D. Schully, Daniela Seminara, and Mukesh Verma

Abstract

The Epidemiology and Genomics Research Program (EGRP) at the National Cancer Institute (NCI) is developing scientific priorities for cancer epidemiology research in the next decade. We would like to engage the research community and other stakeholders in a planned conversation in December 2012 to help shape new foci for cancer epidemiology. In defining the future of cancer epidemiology, we invite the research community to participate in a research-based conversation at <http://blog-epi.grants.cancer.gov/> to develop high-impact studies. *Cancer Epidemiol Biomarkers Prev*; 1–3. ©2012

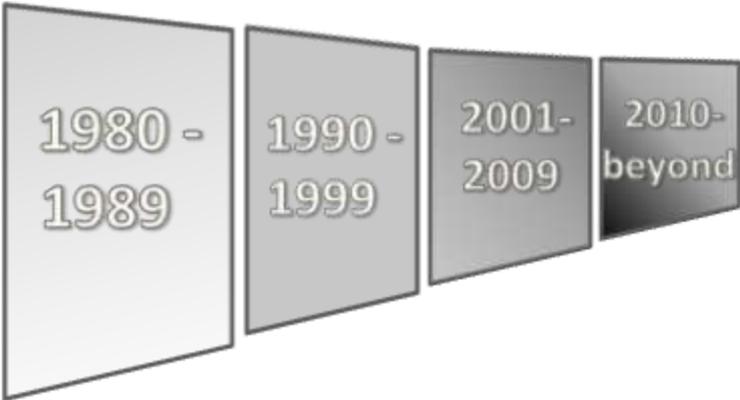
In recognition of the 20th year of publication of *CEBP*, the editor (1) proposed a series of invited commentaries from experts in various disciplines to reflect on major advances and trends in cancer epidemiology over the last two decades and to foresee "what lies ahead." Pieces published in commentaries this month represent the first

EGRP grants in numbers this period research

*Excerpt from Khoury et al., CEBP July 2012; 21(7): 999-1001 used with permission of American Association of Cancer Research.*

# Brief Timeline of Cancer Epidemiology

**1937-1979**



**1937**      **1940**      **1950**      **1960**      **1970**

NCI established

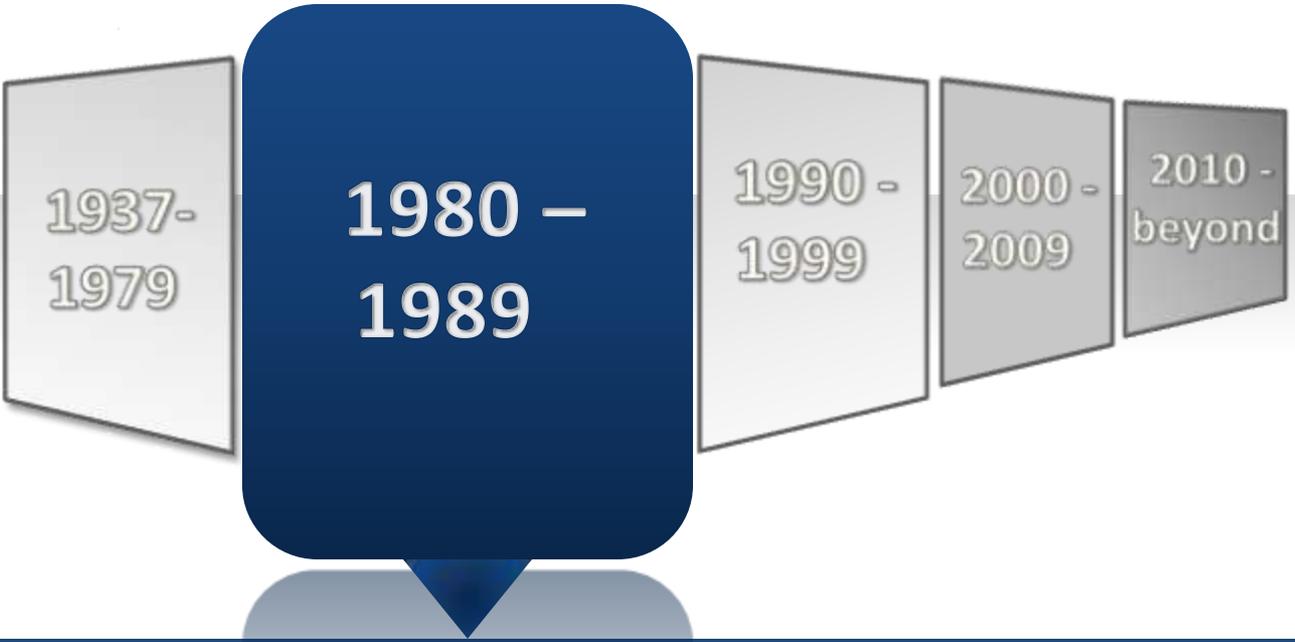
Asbestos linked to lung cancer

Warning labels added to cigarette labels

DES linked to vaginal adenocarcinoma

Adapted from Greenwald P and Dunn BK. *Cancer Res.* 2009; 69(6): 2151-8.

# Brief Timeline of Cancer Epidemiology



1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
	Hepatitis B vaccine shown to prevent liver cancer		HPV DNA identified in cervical biopsies		<i>H. pylori</i> linked to gastric cancer				Gail model used to calculate breast cancer risk

Adapted from Greenwald P and Dunn BK. *Cancer Res.* 2009; 69(6): 2151-8.

# Brief Timeline of Cancer Epidemiology



1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
------	------	------	------	------	------	------	------	------	------

Li-Fraumeni and Lynch Syndromes

*APC* increases risk of Colorectal cancer

ATBC and CARET trials show association between dietary vitamins and cancer

*BRCA1* increases risk of breast and ovarian cancer

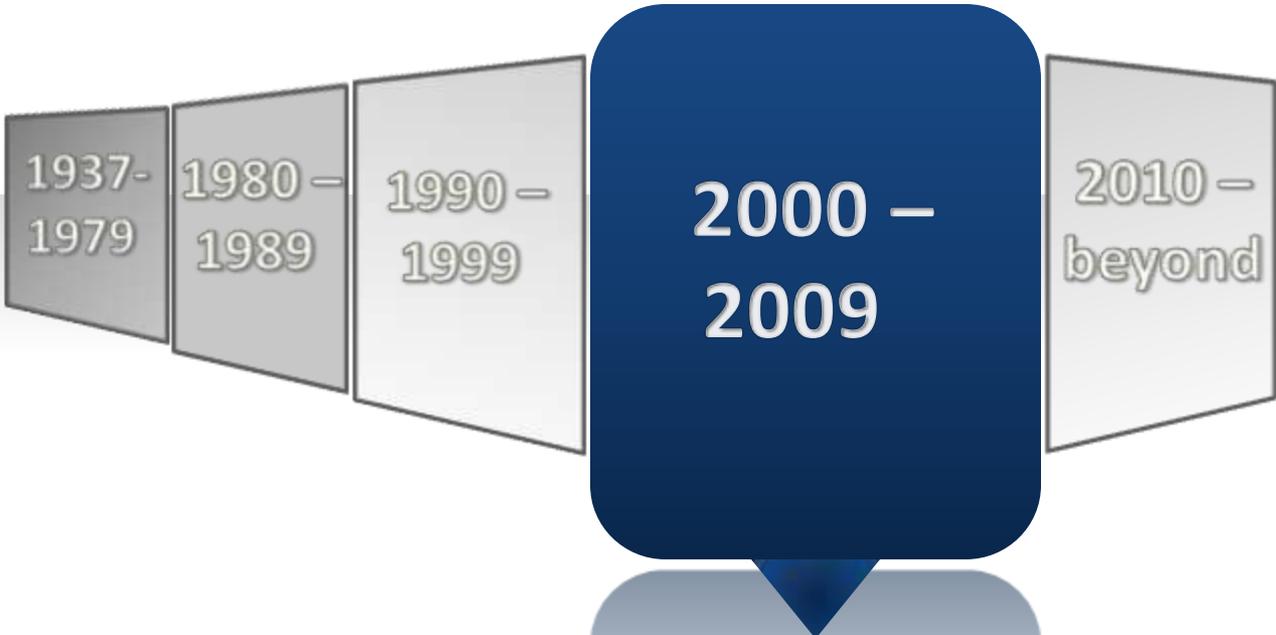
*BRCA2* increases risk of breast and ovarian cancer

WCRF/AICR recommendation for diet, BMI, obesity and physical activity to reduce cancer risk

Tamoxifen reduces breast cancer in ER+ women

Adapted from Greenwald P and Dunn BK. *Cancer Res.* 2009; 69(6): 2151-8.

# Brief Timeline of Cancer Epidemiology

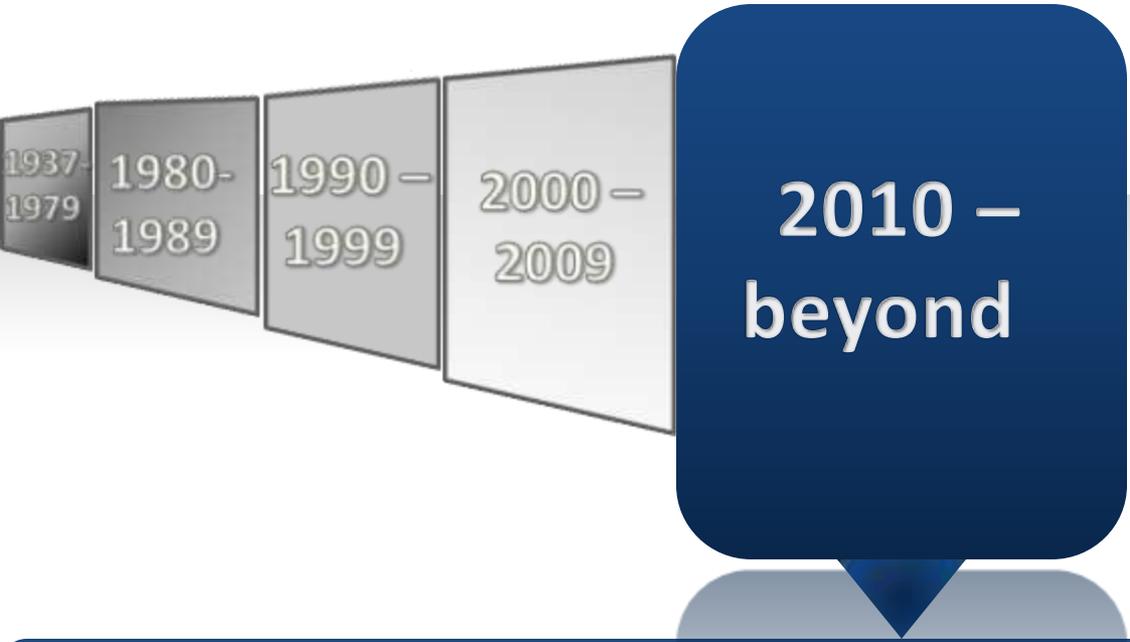


2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
------	------	------	------	------	------	------	------	------	------

	Human Genome Project completed	HRT increases breast cancer risk			GWAS studies launched	HPV vaccine approved to prevent four forms of HPV	NIH's GEI program launched		
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Adapted from Greenwald P and Dunn BK. *Cancer Res.* 2009; 69(6): 2151-8.

# Brief Timeline of Cancer Epidemiology



**2010    2011    2012    2013    2014    2015    2016    2017    2018    2019**

EGRP funds its first Exome sequencing study



Today

**the future of epidemiology and how we get there**



12/21/12

Unless the Mayans were right, we need to think about...

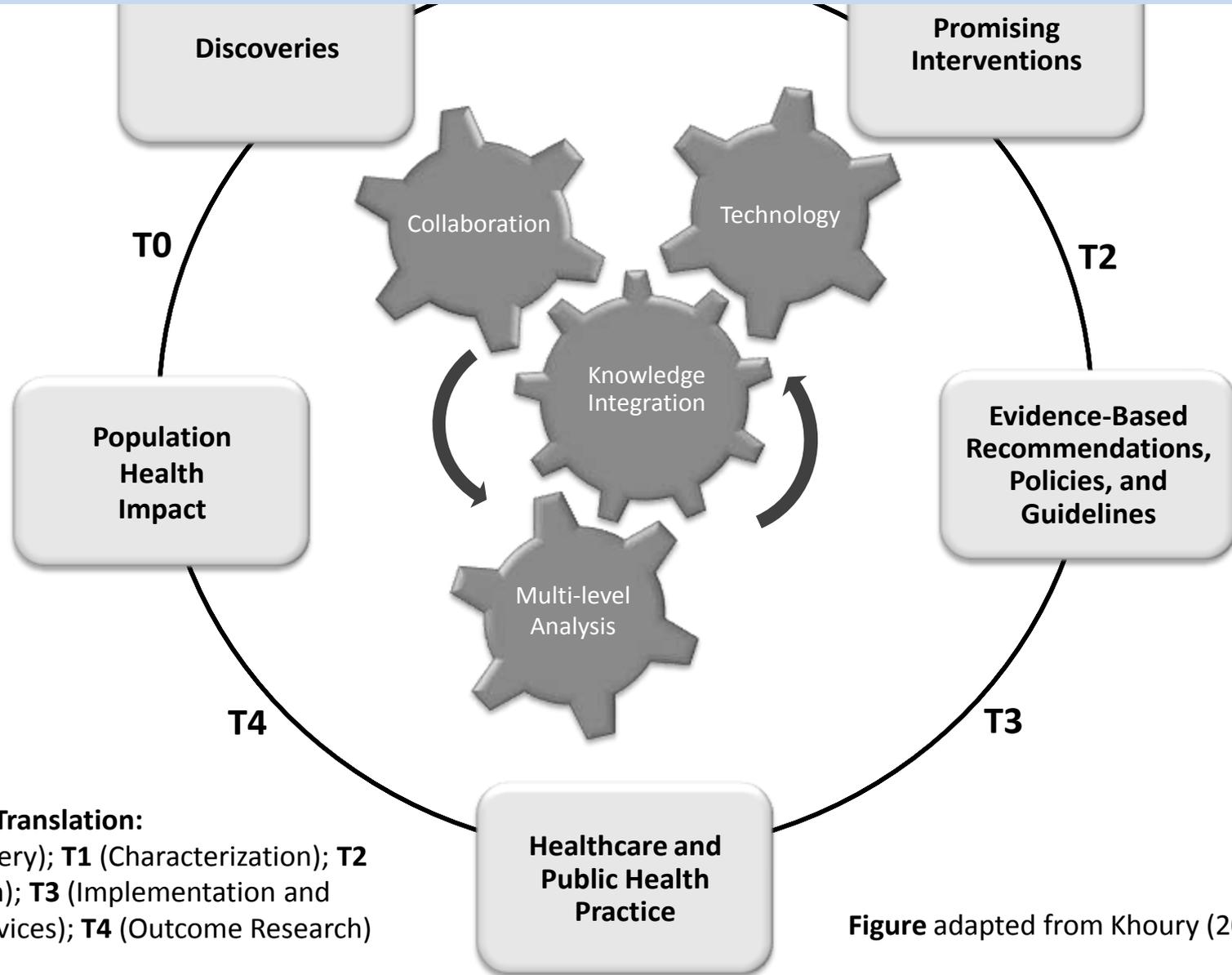
# The Study of Distribution and Determinants of Disease Occurrence and Outcomes in Populations

## Epidemiology comes in different flavors

- By Outcomes: Cancer, Cardiovascular, Diabetes, Birth Defects...
- By Risk Factors: Infectious, Genetic, Nutritional, Environmental, Social.....
- By Life Stages: Reproductive, Perinatal, Pediatric, Geriatric....
- By Context: Descriptive, Analytic, Clinical, Public Health...
- By Methodologies: Observational, Experimental (RCT)....
- **By Phase of Translation: from Discovery to Population Health**

# Four “Drivers” of Epidemiology in the Context of Translational Research

Lam TK et al. “Drivers” of translational cancer epidemiology in the 21<sup>st</sup> century: needs and opportunities. *Cancer Epidemiol Biomarkers Prev.* 2013 Jan [Epub ahead of print]

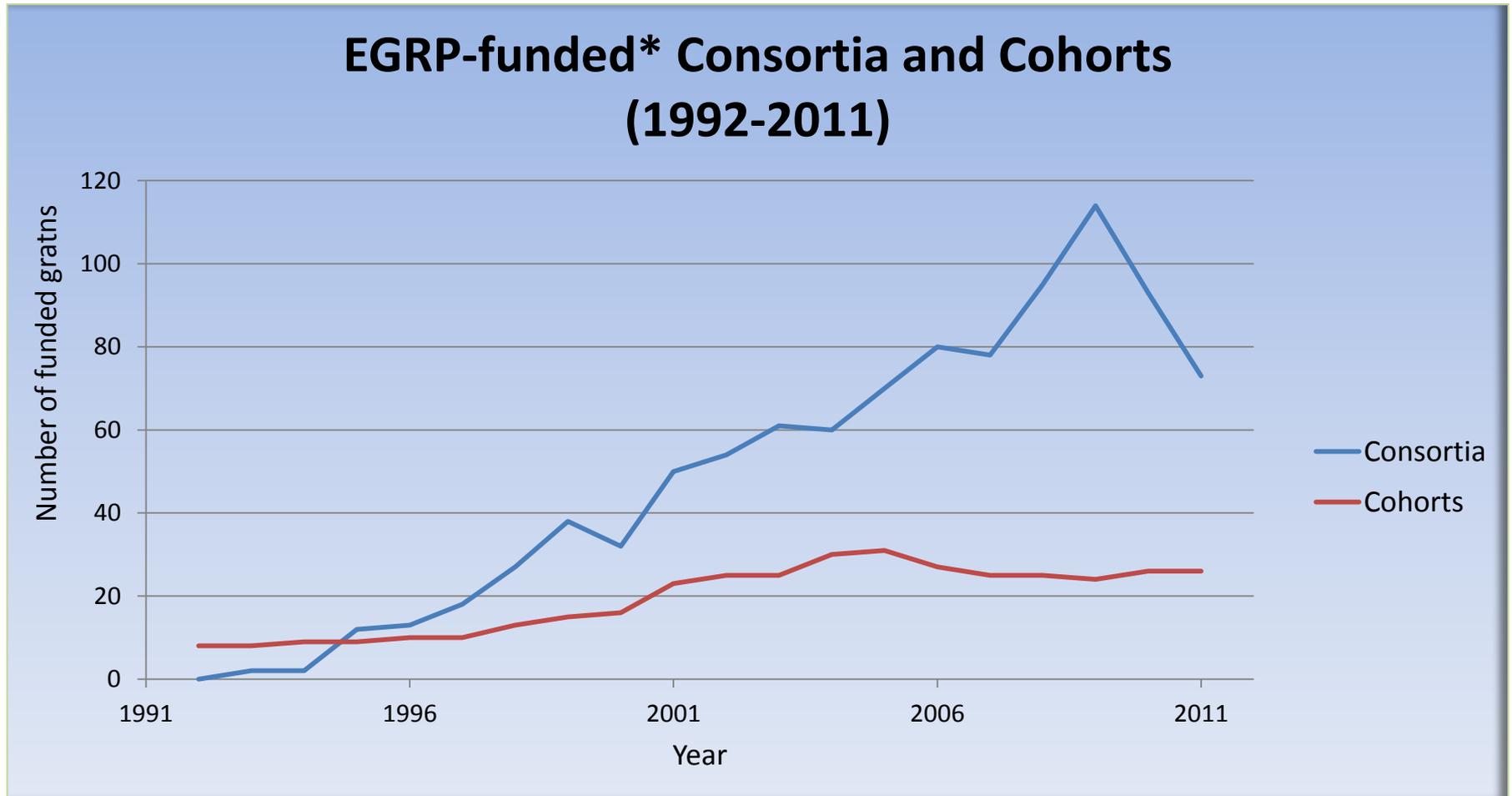


## Phases of Translation:

**T0** (Discovery); **T1** (Characterization); **T2** (Evaluation); **T3** (Implementation and Health Services); **T4** (Outcome Research)

Figure adapted from Khoury (2011)

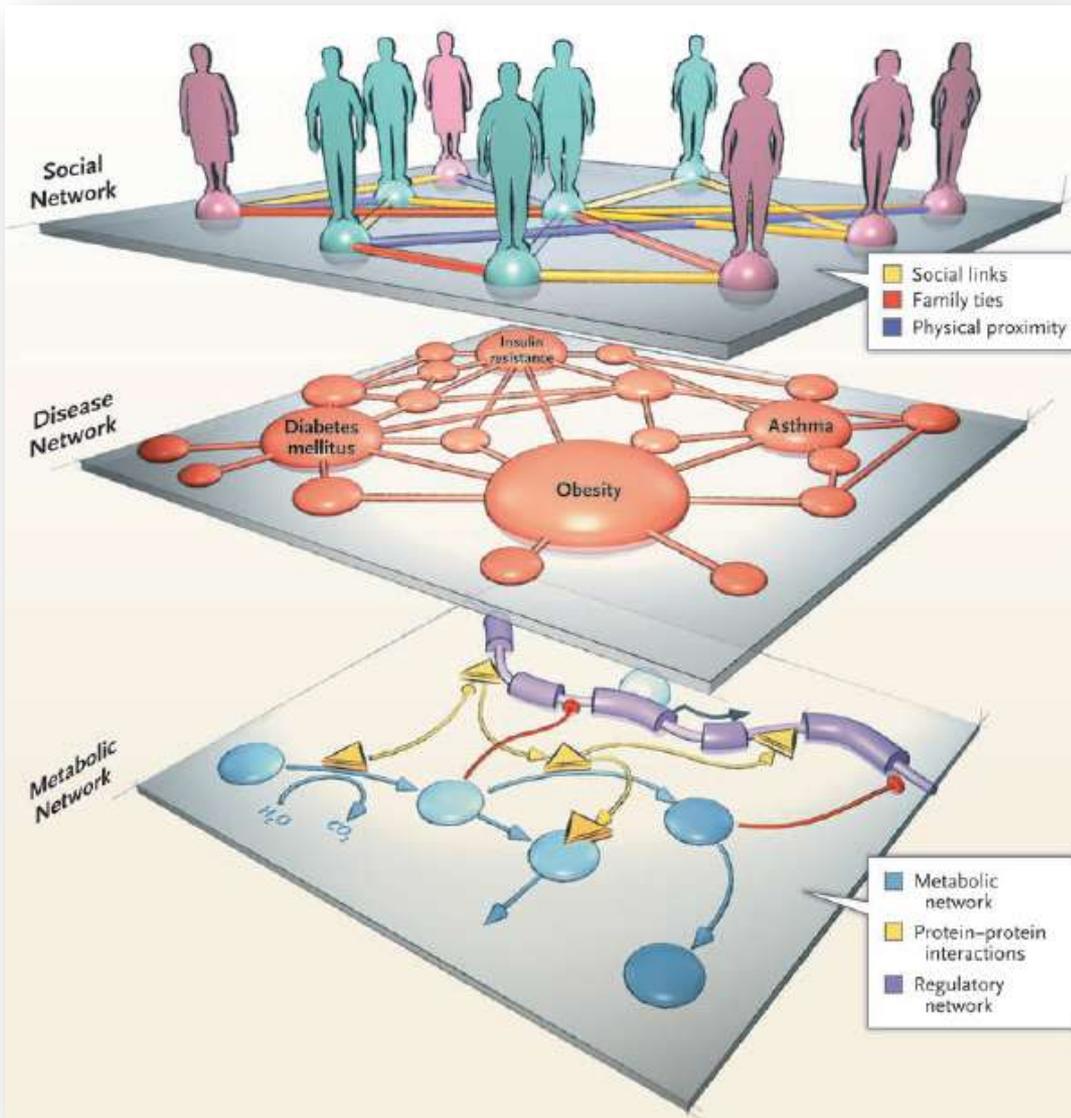
# Collaboration: Trends in Funded Research



**Source:** Epidemiology & Genomics Research Program (EGRP), <http://epi.grants.cancer.gov/>

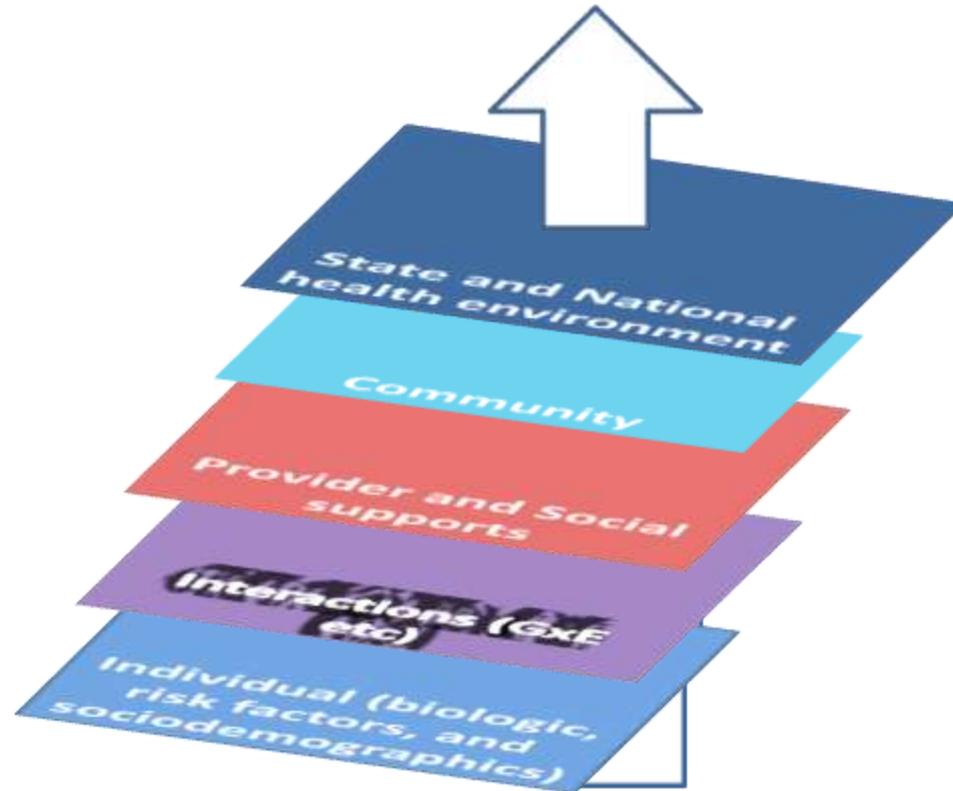
\*Prior to 1997, EGRP did not exist, so some grants funded by other NCI Divisions/Programs

# Multi-level Analysis: The Example of Obesity



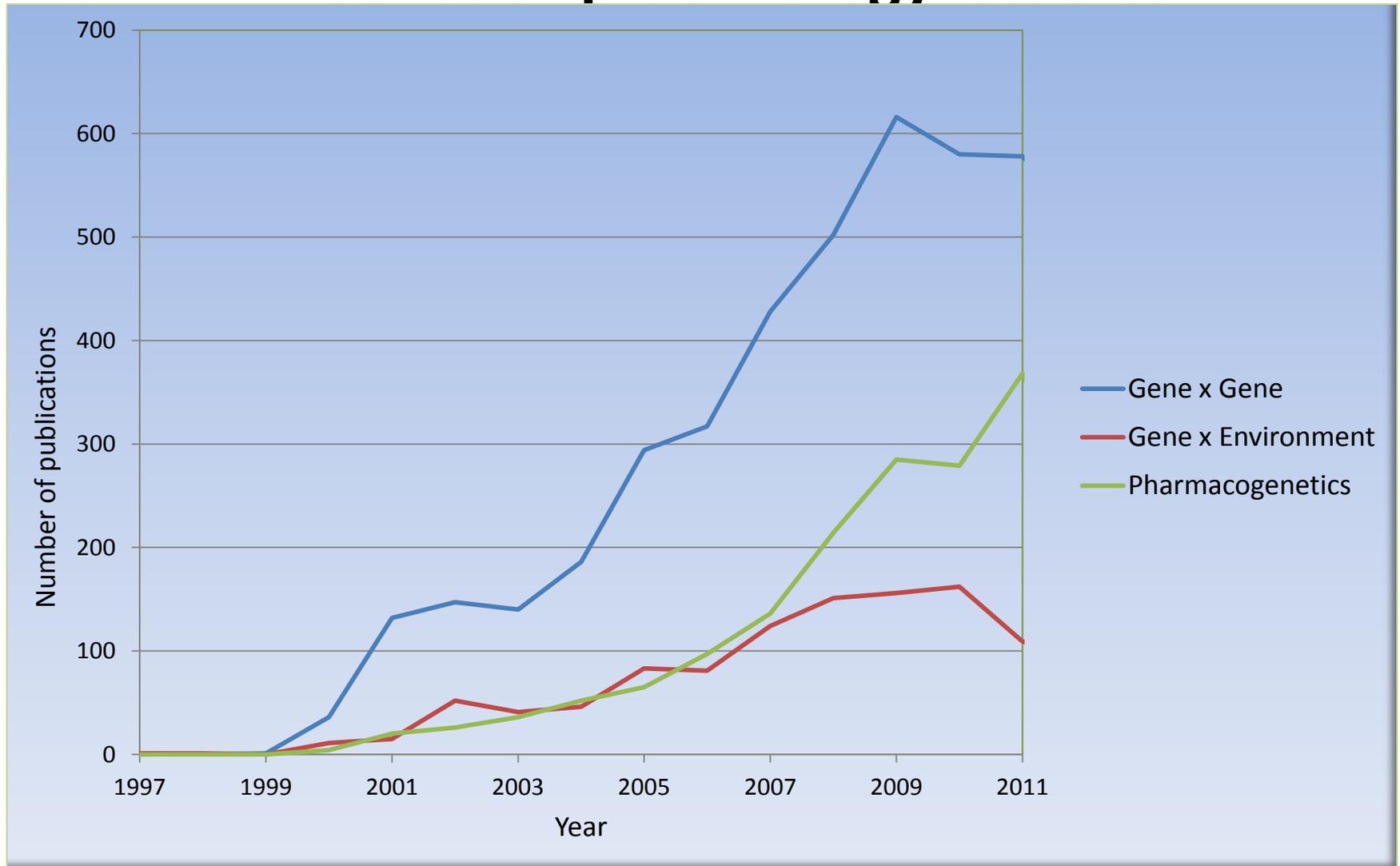
*From NEJM, Barabási, Network Medicine – From Obesity to the “Diseasome,” 357 (4), 404-7. Copyright © (2007) Massachusetts Medical Society. Reprinted with permission from Massachusetts Medical Society.*

# Multi-Level Analysis: Trends in Published Research



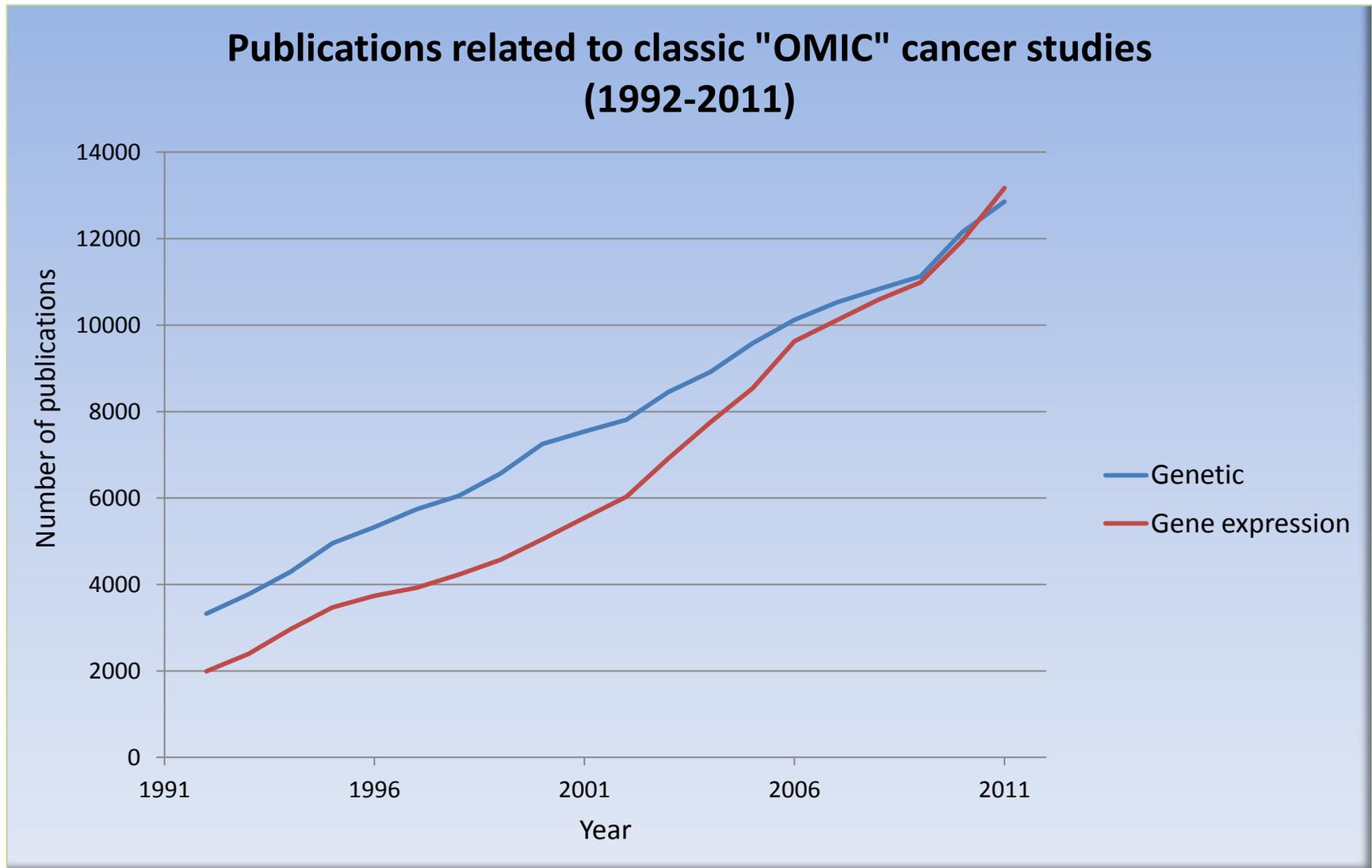
- A quick look at 300 random publications from 2000, 2005, and 2010 reveals very few multi-level analyses in the cancer epidemiology literature beyond GxE at the individual level

# Multi-level Analysis: Trends in G-G and G-E in Genetic Epidemiology Studies



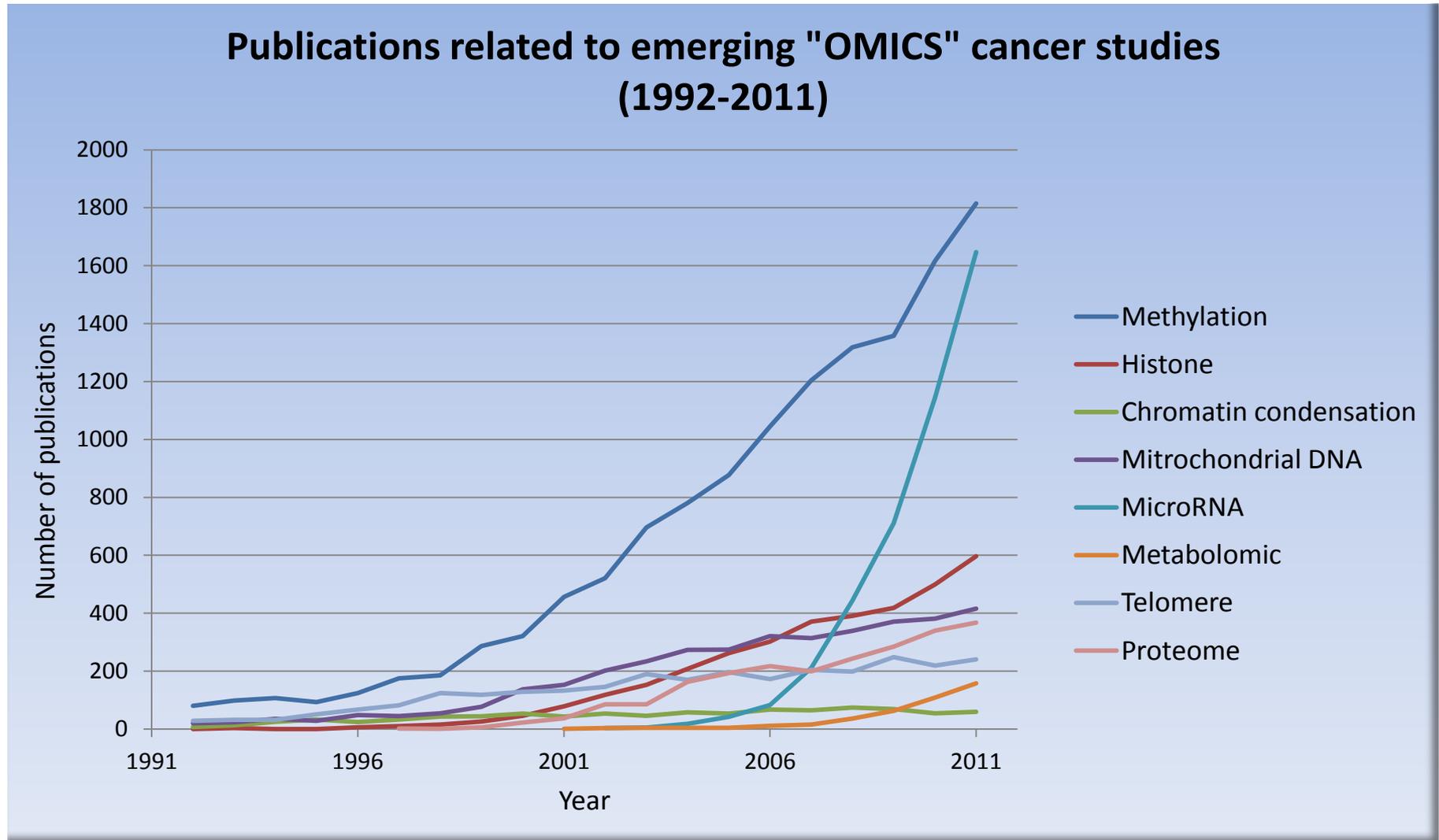
Source: HuGE Navigator, <http://hugenavigator.net/HuGENavigator/startPagePubLit.do>

# Technology: Trends in Published Research (1 of 3)



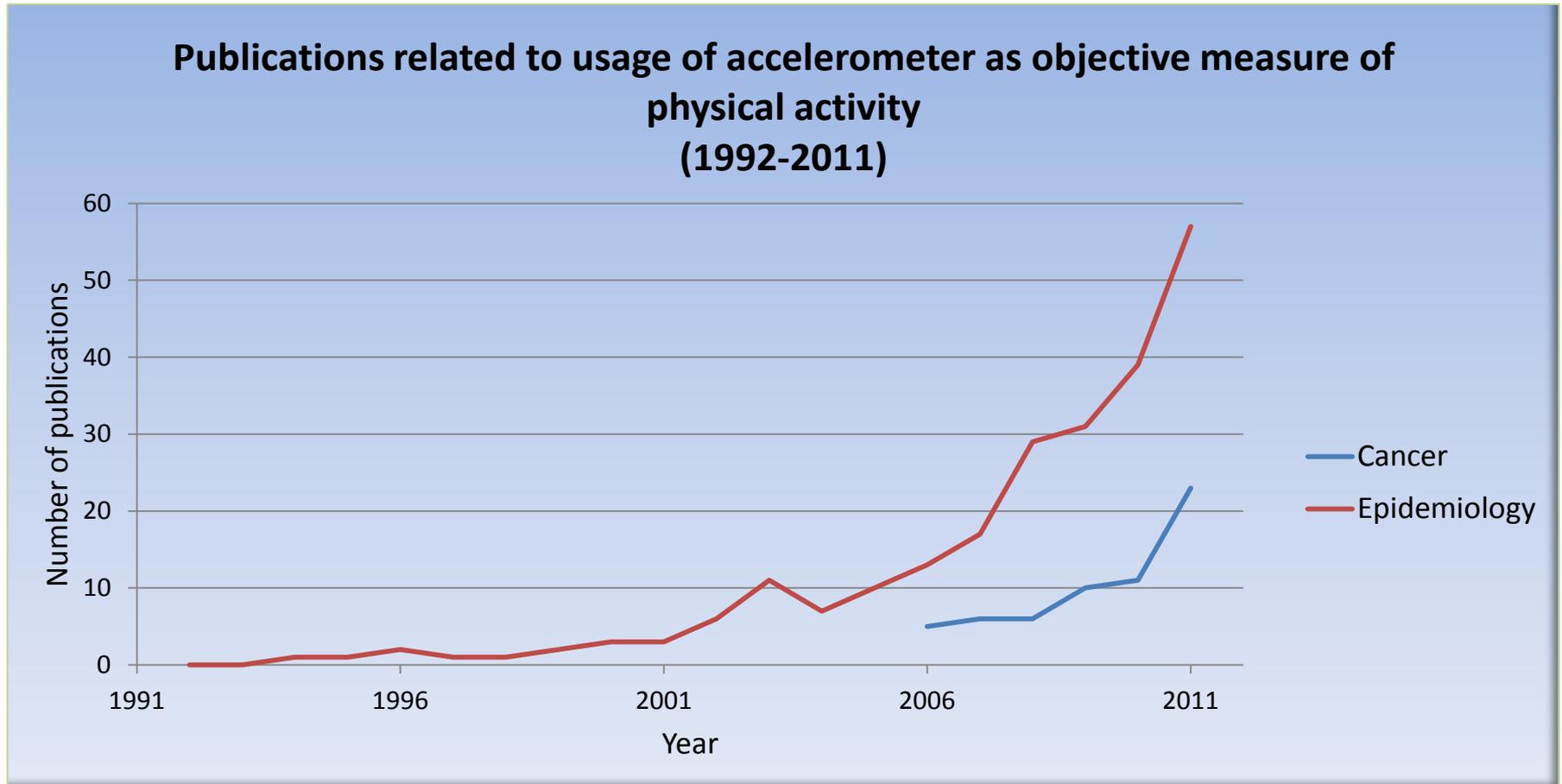
**Source:** PubMed search excluded reviews, meta-analyses, systematic reviews and filtered on cancer and humans

# Technology: Trends in Published Research (2 of 3)



**Source:** PubMed search excluded reviews, meta-analyses, systematic reviews and filtered on cancer and humans

# Technology: Trends in Published Research (3 of 3)

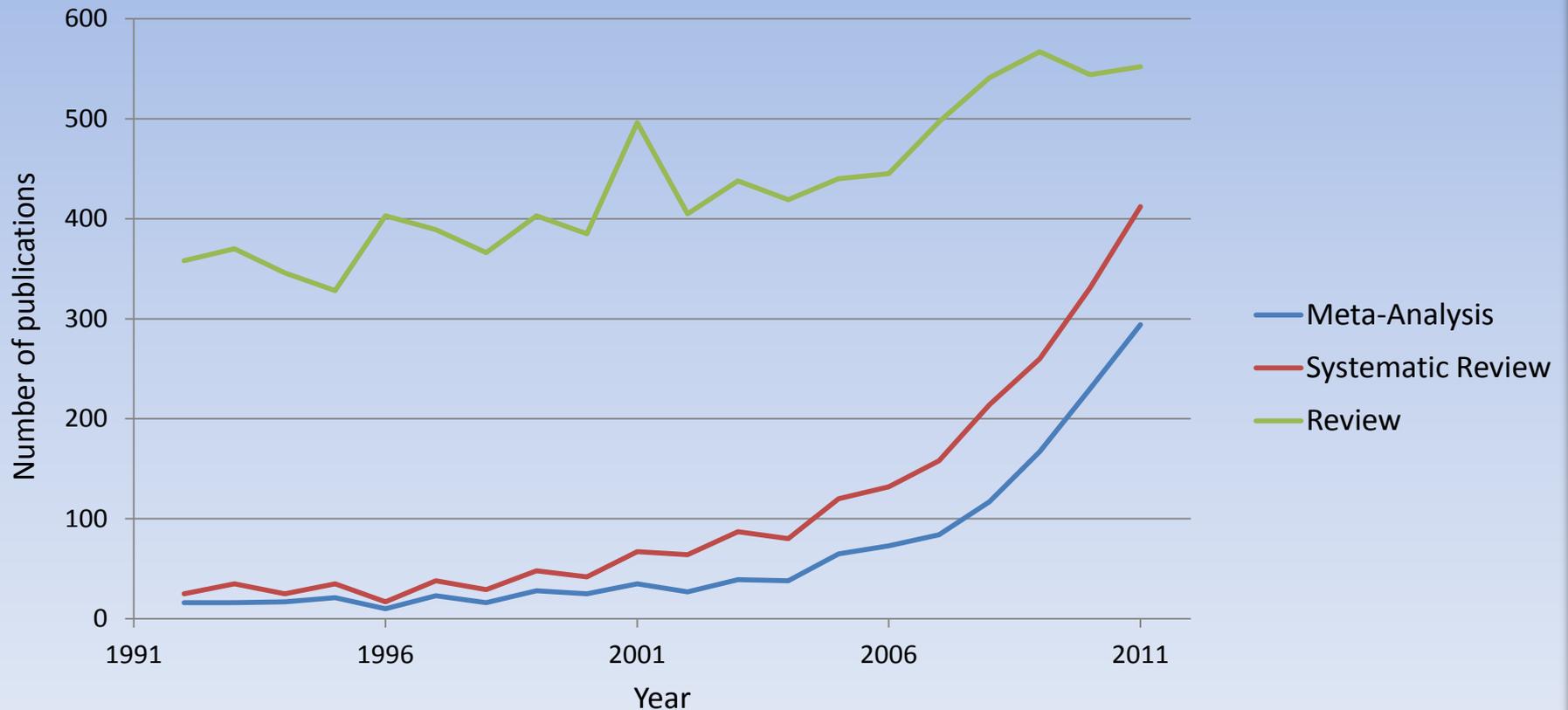


**Source:** PubMed search excluded reviews, meta-analyses, systematic reviews and filtered on cancer and humans

**Related Reference:** Verma M, Khoury MJ, Ioannidis JPA. *Cancer Epidemiol Biomarkers Prev.* (in press)

# Knowledge Integration: Trends in Published Research

## Publications on cancer epidemiology (1992-2011)



**Source:** PubMed search excluded trials and treatment studies and filtered on cancer and humans  
**Reference:** Ioannidis JP, Schully S, Lam TK, Khoury MJ. *CEBP*. Oct 23, 2012 [epub ahead of print]

Welcome to the Era of  
“Omic” and “Big Data” Epidemiology!

Which Brand of Epidemiology will  
Show up in the 21<sup>st</sup> Century?

Incidentalomic Epidemiology vs.  
Translational Epidemiology

# Translational Epidemiology

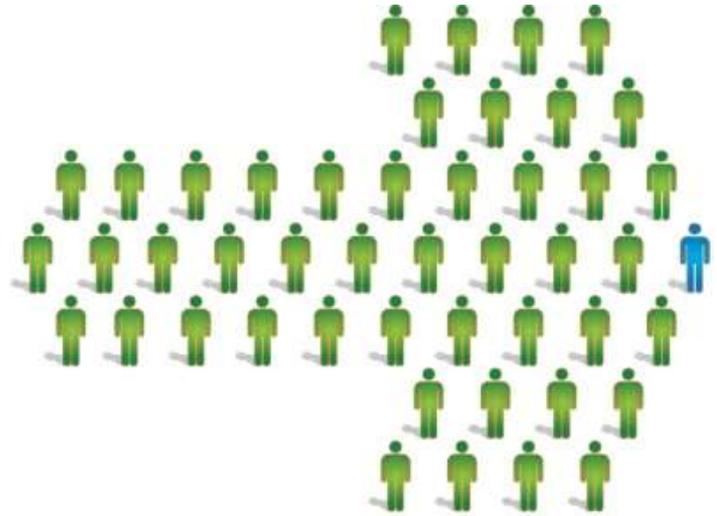
AJPH 1999

- Khoury MJ, Gwinn M, Ioannides JPA. The emergence of translational epidemiology: from scientific discovery to population health impact. *Am J Epidemiol.* 2010 September 1; 172 (5): 517-24.
- Koplan JP, Thacker SB, Lezin NA. Epidemiology in the 21<sup>st</sup> century: calculation, communication, and intervention. *Am J Public Health.* 1999 August; 89 (8): 1153-55.

AJE 2010

**Welcome to 12-12-12**

**TRENDS** IN  
**21** <sup>ST</sup> **CENTURY**  
**EPIDEMIOLOGY**



From Scientific Discoveries to Population Health Impact

DECEMBER 12-13, 2012- NIH CAMPUS, BETHESDA, MD

Our Big Objective: Come up with 12  
recommendations for action to Influence the field of  
epidemiology in the next 12 years

# Session 1: The Evolution of Epidemiology and its Applications to Cancer

- “Historical perspectives on the evolution of cancer epidemiology” by Bob Hoover
- Panel’s questions:
  1. What lessons and success stories have we learned from 20<sup>th</sup> century cancer epidemiology?
  2. What are the major scientific questions that cancer epidemiology should address in the next decade to impact public health?

# Session 2: The Impact of New Methods and Technologies on Epidemiologic research

- “Technology-driven epidemiology: a paradigm shift” by Geoff Gingsburg
- Panel’s questions:
  1. Which technologies do you feel are ready for “prime time” in epidemiologic research and for what purpose?
  2. What criteria would you use to determine when emerging technologies should be integrated into epidemiologic research?

# Session 3: The Evolution of Epidemiologic Cohorts in the Study of Natural History of Cancer and Other Diseases

- “What have we learned from epidemiology cohorts and where should we be going next?” by Julie Buring
  
- Panel’s questions:
  1. What developments are needed to make epidemiologic cohorts a cornerstone of the discovery to practice continuum?
  2. How should NCI and NIH facilitate multidisciplinary collaboration to integrate these developments into the research portfolio?

# Session 4: Use of Epidemiology to Advance Clinical and Public Health Practice

- “Epidemiology and evidence-based research along the cancer care continuum” by David Ransohoff
  
- Panel’s questions:
  1. What are new ways in which epidemiology can be used to fill evidence gaps between discoveries and population health impact?
  2. How can observational epidemiology make the greatest scientific contributions in understanding cancer-related risk factors that cannot be studied through randomized clinical trials?

# Session 5: Use of Epidemiology in Knowledge Integration and Meta-Research

- “The role of epidemiology in knowledge integration and meta research” by John Ioannidis
  
- Panel’s question:
  1. How can epidemiology help integrate knowledge from basic, clinical and population sciences to accelerate translation from research to practice?

## **Session 6: Where do We Go From Here?**

- General Discussion Moderated by Patricia Hartge
- Objective: 12 Recommendations for Action for Epidemiology in the Next 12 Years

# Engaging the Scientific Community

- The digital conversation started via our blog 6 months ago
- This meeting is being webcast to the community at large (smile for the camera)
- We will also be monitoring an email box and Twitter feed for questions from the community at large
- We will continue the dialogue after 12/13/12

# Your Charge!

- Engage, participate, invigorate!
- Think provocatively and creatively about the future of cancer epidemiology and how the discipline needs to evolve with a changing landscape
- Engage online and tweet about the meeting
  - Email questions to [nciepimatters@mail.nih.gov](mailto:nciepimatters@mail.nih.gov)
  - Ask questions on Twitter (Follow @NCIEpi; #TrendsInEpi)
- Engage others and continue the conversation after you leave tomorrow

# A Big Thank You

## Planning Committee:

- Bob Hoover
- Muin Khoury
- Tim Rebbeck
- Sheri Schully

## EGRP Scientific Team:

- Mahesh Divi
- Joanne Elena
- Tram Kim Lam
- Stefanie Nelson
- Joseph Su

## EGRP Communications Team:

- Christie Kaefer
- Dacia Beard
- Audrey Babkirk

## EGRP Fellows:

- Christine Chang
- Paul Ebohon

## CMP:

- Trinh Lieu